WSR-88D Transmitter Reliability Study

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Executive Summary

This study was undertaken in response to CCR 99-00073 entitled "Transmitter Upgrade" dated 08/16/1999. The cost of repair for the entire fleet of **1**82 transmitters for the major subassemblies of the transmitter was evaluated against reliability data. A comparison between Inherent Reliability as predicted in the WSR-88D Reliability and Maintenance Assessment and Analysis report CDRL 239 dated 15 May 1989 vis-a-vis FY2002 and FY2003 Achieved Reliability as experienced by the WSR-88D Reconditioning Center was made with a view towards highlighting those areas of the transmitter which would profit most by an upgrade effort using available funds. A Modification/Redesign of the Trigger Amplifier R400-3A11 is indicated.

Conclusions

The overall Transmitter maintenance picture at NRC is good at this time. No back orders and/or low stock conditions have been experienced since the incorporation of ROC/NRC Reliability changes in FY1998-FY2000 time frame. The change to the Backswing Diode Stack 3A12A3 was particularly effective and is a big contributor to the excellent reliability presently achieved by the Modulator 3A12 and it's subassemblies.

The excellent reliability achieved by the Klystron argues against any effort to replace it by semiconductor devices. The Klystron is a mature, reliable technology. There are presently two vendor sources of repair capability. Incidently, the Klystron is the only significant assembly which is a vendor repair item. NRC has done an excellent job of developing In-House repair capability and is saving the Government many thousands dollars yearly in repair cost on the WSR-88D project.

Although ROC/NRC reliability changes have improved the Failure Rate of the Trigger Amplifier 3A11, the reliability study has revealed that this is still a fruitful area of upgrade effort. A reasonably successful upgrade to the Trigger Amplifier should result in a Repair Cost saving of approximately $150K per year. To put this in perspective, the entire NRC transmitter yearly Cost to Repair is presently $500K.

Recommendations

An ECP should be initiated to upgrade the Trigger Amplifier 3A11 in response to CCR 99-00073 ASAP. The ECP effort should consist of generating the necessary information to produce a Request for Proposal which can be competed by recognized suppliers for a re-design of a form, fit and function replacement for the Trigger Amplifier.

A parallel in-house (ie., ROC Engineering) effort to investigate a reliability retrofit change to the present Trigger Amplifier is also recommended on a resource available basis.

Detailed Data

The detailed data for the principal transmitter Repair Cost drivers are as listed below:

* **Klystron 3V1**

The Klystron Inherent Failure rate is 15.7 failures/Million hours while the Achieved Failure rate is 14 failures/Million hours. The yearly cost to repair of this unit is $421K. Although this is a major cost driver, it is not considered to be a fruitful area for upgrade due to it's excellent Achieved Reliability.

* **Modulator 3A12 and it's subassemblies**

The Modulator and it's subassemblies have an Inherent Failur4e rate of 77 Failures/Milli9n hours and an Achieved Failure Rate of 96 Failures per Million hours. The yearly cost to repair is $158.1K. Due to it's excellent reliability and relatively modest cost to repair, the Modulator and it's subassemblies is not considered a fruitful area for upgrade.

*** Trigger Amplifier 3A11**

The Trigger Amplifier has an Inherent Failure rate of 22.9 Failures/Million Hrs. And an Achieved Failure Rate of 145 Failures/Million Hrs. The yearly cost to repair is $224K. This is obviously an excellent candidate for Modification/Redesign.